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Remote Location Monitoring of Dam and Risk Warning System for Flood using GSM Technology

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ABSTRACT

GSM is the most popular technology used in mobile communication.GSM based control system can act as an embedded system that can control and monitor appliances and other devices. There is an automation process by using GSM technology which provides water level indication in various applications like dam, water reservoirs, groundwater monitoring etc. The system allows the user to effectively monitor the water level via mobile by sending commands in the form of SMS and receiving water level status. The type operation to be performed depends on the nature of the SMS sent. The main part includes the development of the system that is capable to detect water level using microcontroller. The sent SMS is stored and polled from the receiver mobile station and then the required control signal is generated and sent to the intermediate hardware that we have designed according to the command received in form of the sent message. The microcontroller is used for processing the network protocols. The system can process the data that has been collected based on the water level. Though this technology is initially meant for dam monitoring, it can be easily adapted to other fields.

I. INTRODUCTION

At least 49,000 existing large dams are fragmenting nearly half of the world's rivers. A dam has large capacity, and it is usually kept partially full. So, when it rains heavily or there is a big snow melt-off, a large amount of water can be captured in the dam and released slowly downstream. If the dam hadn't been there, a huge amount of water could have rushed down the rivers and flooded downstream. Dams can stabilize the water levels of inland lakes and seas. When water increases to a dangerous level and is not monitored by the authorities, and then dam failure can cause potential catastrophic damage to life and property. However, this condition can be prevented if the authorities always know the current status of the water level. Therefore a technology needs to be developed to tackle this problem and making the system more organized. Therefore, designing of water level indicator is one of the technological advancement to transmit data and send it to authority for controlling. The systems also give an alert to authority to take immediate action if water level increases to dangerous level. The system can be applied at the river-banks, low-lying areas, dam and the village far from town and also can be used for industrial sector. It is an effective method to transmit, analyze, manage and give a feedback. The authorized person will take an immediate action to monitor the water level[1]. With the implementation of this project, it will reduce the number of workers involved during a work in progress. The use of this tool is not limited to dam, but it can be applied to other fields.

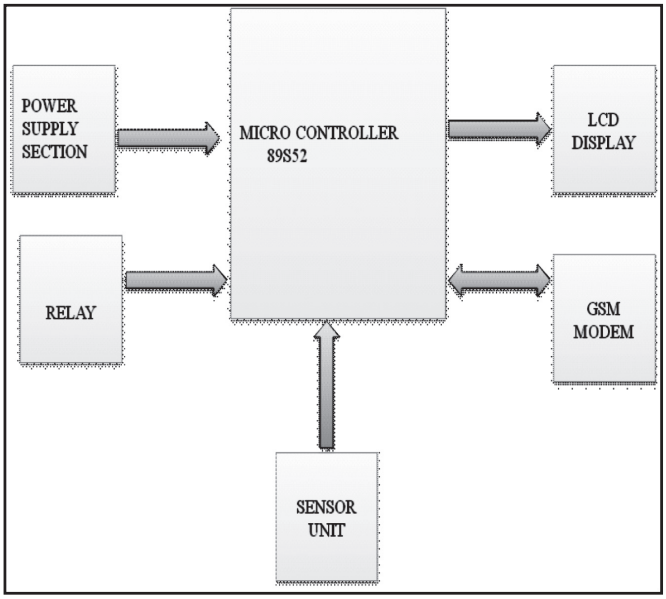

Fig. 1: Block Diagram of Water Level Indicator Based On GSM

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II. FACTORS INFLUENCING HARDWARE DEVELOPMENT

Various factors play an important role to adapt a complete system based on a particular technology.

- **Time:** When water rises above safe region then this is the golden period to start the flood mitigation plans. The duration taken from alert till the information is send to responsible authorities is very important and should be done in shortest time possible. Every second is precious for the rescue team to help and save the victims.
- **Cost:** Device cost and maintenance cost plays crucial role to implement the hardware. If the cost of device is high, it will be restricted to limited areas. Maintenance cost is a long term investment until the device is in use.
- **Plan:** During calamity the authorities have to make wise decisions to save victims. The authorities have to plan according to time and resources available to them.

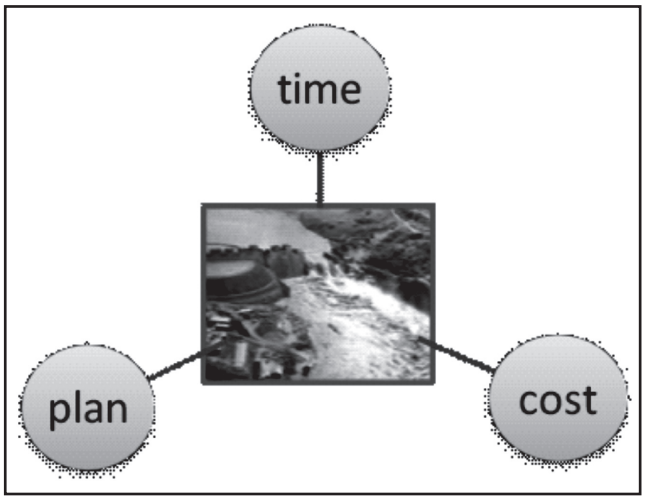

Fig. 2: Important Factors

2.1 Technologies Available

(A). GLOBAL SYSTEM FOR MOBILE (GSM):

- It is a standard set developed by ETSI (European Telecommunication Standard Institute) to describe protocols for second generation digital cellular networks used by mobile.
- GSM was expanded over time to include data communications, first by circuit switched transport, then packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS).
- A **GSM modem** is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone.
- GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery. GSM modem is preferable to GSM phone due to the disadvantage of the charging related to the mobile phones. GSM modems can be a quick and efficient way to send and receive SMS, because a special subscription to an SMS service provider is not required. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/ receiving SMS messages[3].
- The main difference between the dial-up modem and GSM modem is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

(b) ZIGBEE:

- It is a specification for a suite of high level communication protocols using small and low power digital radios based on IEEE 802 standard for personal area network.
- These devices are often used in mesh network form to transmit data over long distances and passing data through intermediate devices to reach large distance.
- This allows ZigBee networks to be formed *ad-hoc*, with no centralized control or high-power transmitter/ receiver able to reach all of the devices.
- It is targeted at applications that require a low data rate, long battery life, and secure networking.
- It has a defined rate of 250 kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device.
- Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth or Wi-Fi.
- ZigBee nodes can go from sleep to active mode in 30 ms or less, the latency can be low and devices can be responsive, particularly compared to Bluetooth wake-up delays, which are typically around three seconds. Because ZigBee nodes can sleep most of the time, average power consumption can be low, resulting in long battery life.
- ZigBee devices are of three types:
- ZigBee Co-ordinator (ZC): The most capable device, the Co-ordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee Co-ordinator in each network since it is the device that started the network originally .It stores information about the network, including acting as the Trust Centre & repository for security keys.
- ZigBee Router (ZR): In a running application function, a ZigBee Router can act as an intermediate router, passing on data from other devices.

- ZigBee End Device (ZED): ZED contains just enough functionality to communicate to the parent node and cannot relay data from other devices. Hence this relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory and therefore can be less expensive to manufacture than a ZR or ZC.

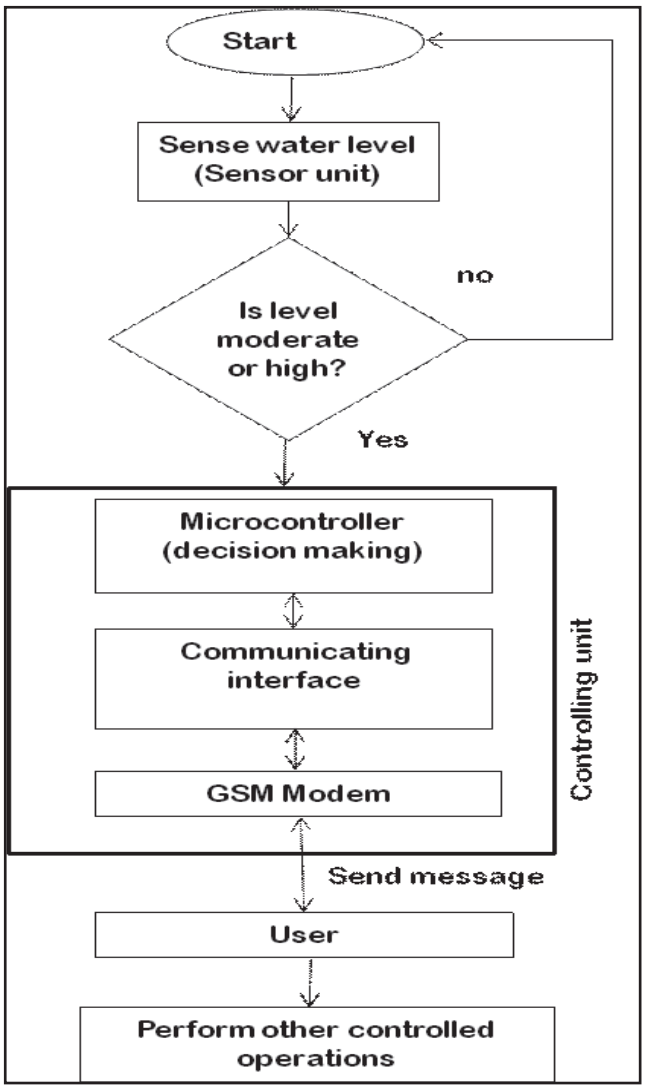

Fig. 3: Flow Diagram of Water Level Indicator Using GSM

III. DESIGN AND IMPLEMENTATION

The first stage of designing involves a water level sensor that is made for sensing water level accurately. If water level is at moderate or high level then sensors sends message to the microcontroller otherwise it senses the water level again. Microcontroller is used to control the overall system automatically that reduces the design and control complexity. Microcontroller takes input from the sensor unit and sends the signal to the GSM modem after processing data. GSM modem then sends the message to the user's phone. The user then takes appropriate action and performs other controlled operations.

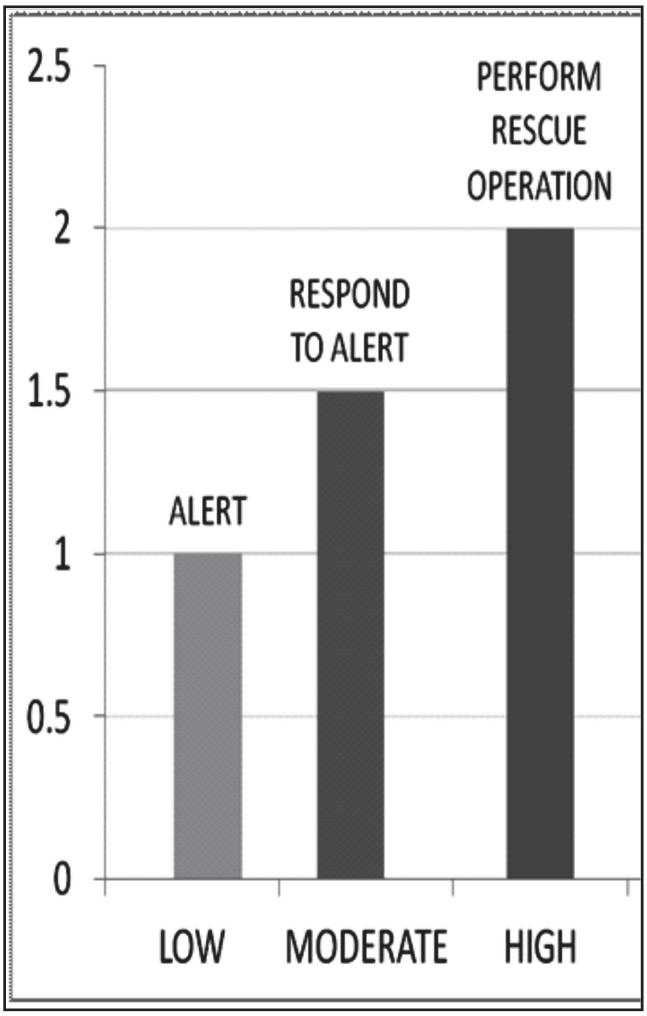

Fig. 4: Level Distribution

Factors	Conventional system	GSM based system
Reception of water level alerts	No	Automatic
Display warning signs	No	Automatic
Cost of installation	Daily basis	Low cost

IV. CONCLUSION

Failure of dams can be devastating to life and property. Therefore a solution for this problem is presented in this paper. By using a mobile phone one can monitor the water level in dams so that water level above high risk level can be alerted immediately by

the use of remote measurements. This makes it convenient for the user and helps in reducing danger caused by dam failures. This paper can be used as a reference for realizing other projects such as weather forecasting, temperature updates, device synchronization, etc [5]. Hence it justifies that any device can be controlled remotely. This system can be linked to relays which can automatically control the switching of gates by allowing excess water to flow.

V. FUTURE WORKS

Sensors are important elements in the system. Further studies on wireless sensor technology will be best to replace the current sensors. Precise and accurate detection of water level will improve the data collection system for the monitoring station. The flood alert information's can be displayed on display boards for road users and for safety reasons could be placed at strategic locations. A possible means of power supply for the centralized control unit can be solar cells. The use of solar energy will be cheaper. The GSM technology can be replaced by ZIGBEE.

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